

## Leonardo da Vinci

{lay-oh-nar'-doh dah vin'-chee}

The life and work of the great Italian Renaissance artist and scientist Leonardo da Vinci have proved endlessly fascinating for later generations. What most impresses people today, perhaps, is the immense scope of his achievement. In the past, however, he was admired chiefly for his art and art theory. Leonardo's equally impressive contribution to science is a modern rediscovery, having been preserved in a vast quantity of notes that became widely known only in the 20th century.

### LIFE

Leonardo was born on Apr. 15, 1452, near the town of Vinci, not far from Florence. He was the illegitimate son of a Florentine notary, Piero da Vinci, and a young woman named Caterina. His artistic talent must have revealed itself early, for he was soon apprenticed (c.1469) to Andrea VERROCCHIO, a leading Renaissance master. In this versatile Florentine workshop, where he remained until at least 1476, Leonardo acquired a variety of skills. He entered the painters' guild in 1472, and his earliest extant works date from this time. In 1478 he was commissioned to paint an altarpiece for the Palazzo Vecchio in Florence. Three years later he undertook to paint the Adoration of the Magi for the monastery of San Donato a Scopeto. This project was interrupted when Leonardo left Florence for Milan about 1482. Leonardo worked for Duke Lodovico Sforza in Milan for nearly 18 years. Although active as court artist, painting portraits, designing festivals, and projecting a colossal equestrian monument in sculpture to the duke's father, Leonardo also became deeply interested in nonartistic matters during this period. He applied his growing knowledge of mechanics to his duties as a civil and military engineer; in addition, he took up scientific fields as diverse as anatomy, biology, mathematics, and physics. These activities, however, did not prevent him from completing his single most important painting, *The Last Supper*.

With the fall (1499) of Milan to the French, Leonardo left that city to seek employment elsewhere: he went first to Mantua and Venice, but by April 1500 he was back in Florence. His stay there was interrupted by time spent working in central Italy as a mapmaker and military engineer for Cesare Borgia. Again in Florence in 1503, Leonardo undertook several highly significant artistic projects, including the Battle of Anghiari mural for the council chamber of the Town Hall, the portrait of Mona Lisa, and the lost Leda and the Swan. At the same time his scientific interests deepened: his concern with anatomy led him to perform dissections, and he undertook a systematic study of the flight of birds.

Leonardo returned to Milan in June 1506, called there to work for the new French government. Except for a brief stay in Florence (1507-08), he remained in Milan for 7 years. The artistic project on which he focused at this time was the equestrian monument to Gian Giacomo Trivulzio, which, like the Sforza monument earlier, was never completed. Meanwhile, Leonardo's scientific research began to dominate his other activities, so much so that his artistic gifts were directed toward scientific illustration; through drawing, he sought to convey his understanding of the structure of things. In 1513 he accompanied Pope Leo X's brother, Giuliano de'Medici, to Rome, where he stayed for 3 years, increasingly absorbed in theoretical research. In 1516-17, Leonardo left Italy forever to become architectural advisor to King Francis I of France, who greatly admired him. Leonardo died at the age of 67 on May 2, 1519, at Cloux, near Amboise, France.

### ARTISTIC ACHIEVEMENTS

#### Early Work in Florence

The famous angel contributed by Leonardo to Verrocchio's Baptism of Christ (c.1475; Uffizi, Florence) was the young artist's first documented painting. Other examples of Leonardo's activity in Verrocchio's workshop are the Annunciation (c.1473; Uffizi); the beautiful portrait Ginevra Benci (c.1474; National Gallery, Washington, D.C.); and the Madonna with a Carnation ( c.1475; Alte Pinakothek, Munich). Although these paintings are rather traditional, they include details, such as the curling hair of Ginevra, that could have been conceived and painted only by Leonardo.

Other, slightly later works, such as the so-called Benois Madonna (c.1478-80; The Hermitage, St. Petersburg) and the unfinished Saint Jerome (c.1480; Vatican Gallery), already show two hallmarks of Leonardo's mature style: contrapposto, or twisting movement; and CHIAROSCURO, or emphatic modeling in light and shade. The unfinished Adoration of the Magi (1481-82; Uffizi) is the most important of all the early paintings. In it, Leonardo displays for the first time his method of organizing figures into a pyramid shape, so that interest is focused on the

principal subject—in this case, the child held by his mother and adored by the three kings and their retinue.

### Work in Milan

In 1483, soon after he arrived in Milan, Leonardo was asked to paint the *Madonna of the Rocks*. This altarpiece exists in two nearly identical versions, one (1483–85), entirely by Leonardo, in the Louvre, Paris, and the other (begun 1490s; finished 1506–08) in the National Gallery, London. Both versions depict a supposed meeting of the Christ Child and the infant Saint John. The figures, again grouped in a pyramid, are glimpsed in a dimly lit grotto setting of rocks and water that gives the work its name. Not long afterward, Leonardo painted a portrait of Duke Lodovico's favorite, Cecilia Gallerani, probably the charming *Lady with the Ermine* (c.1485–90; Czartoryski Gallery, Krakow, Poland). Another portrait dating from this time is the unidentified *Musician* (c.1490; Pinacoteca Ambrosiana, Milan). In the great *The Last Supper* (42 x 910 cm/13 ft 10 in x 29 ft 7 1/2 in), completed in 1495–98 for the refectory of the ducal church of Santa Maria delle Grazie in Milan, Leonardo portrayed the apostles' reactions to Christ's startling announcement that one of them would betray him. Unfortunately, Leonardo experimented with a new fresco technique that was to show signs of decay as early as 1517. After repeated attempts at restoration, the mural survives only as an impressive ruin.

### Late Work in Florence

When he returned to Florence in 1500, Leonardo took up the theme of the *Madonna and Child with Saint Anne*. He had already produced a splendid full-scale preparatory drawing (c.1498; National Gallery, London); he now treated the subject in a painting (begun c.1501; Louvre). We know from Leonardo's recently discovered Madrid notebooks that he began to execute the ferocious *Battle of Anghiari* for the Great Hall of the Palazzo Vecchio in Florence on June 6, 1505. As a result of faulty technique the mural deteriorated almost at once, and Leonardo abandoned it; knowledge of this work comes from Leonardo's preparatory sketches and from several copies. The mysterious, evocative portrait *Mona Lisa* (begun 1503; Louvre), probably the most famous painting in the world, dates from this period, as does *Saint John the Baptist* (begun c.1503–05; Louvre).

### SCIENTIFIC INVESTIGATIONS

Written in a peculiar right-to-left script, Leonardo's manuscripts can be read with a mirror. The already vast corpus was significantly increased when two previously unknown notebooks were found in Madrid in 1965. From them we learn, among much else, how Leonardo planned to cast the Sforza monument.

The majority of Leonardo's technical notes and sketches make up the *Codex Atlanticus* in the Ambrosian Library in Milan. At an early date they were separated from the artistic drawings, some 600 of which belong to the British Royal Collection at Windsor Castle.

The manuscripts reveal that Leonardo explored virtually every field of science. They not only contain solutions to practical problems of the day—the grinding of lenses, for instance, and the construction of canals and fortifications—but they also envision such future possibilities as flying machines and automation.

Leonardo's observations and experiments into the workings of nature include the stratification of rocks, the flow of water, the growth of plants, and the action of light. The mechanical devices that he sketched and described were also concerned with the transmission of energy. Leonardo's solitary investigations took him from surface to structure, from catching the exact appearance of things in nature to visually analyzing how they function.

Leonardo's art and science are not separate, then, as was once believed, but belong to the same lifelong pursuit of knowledge. His paintings, drawings, and manuscripts show that he was the foremost creative mind of his time.

David Brown

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**See also: ART; ITALIAN ART AND ARCHITECTURE; PAINTING; RENAISSANCE ART AND ARCHITECTURE.**

fresco painting

{fres'-koh}

Fresco (an Italian word meaning "fresh") is a technique of durable wall painting used extensively for murals (see MURAL PAINTING). In pure, or buon, fresco, a fresh wet layer of plaster is applied to a prepared wall surface and painted with pigments mixed with water. The pigments soak into the plaster, which, when dry, forms a permanent chemical bond fusing paint and wall surface. Another type of fresco, painting on a dry (secco) surface with adhesive binder flakes, is not permanent. Because all fresco is susceptible to humidity and weathering, its use is limited.

Although not universally used for wall painting, fresco has a long history. Magnificent examples of this technique survive from the MINOAN ART of Crete in the second millennium BC. Whereas few Greek frescoes survive, examples of Roman frescoes (prior to AD 79) from HERCULANEUM and POMPEII are preserved. The early Christians (AD 250-400) decorated the Roman CATACOMBS with simple frescoes. The Byzantine era (AD c.500-1300) produced both frescoes and mosaics; the former are now found in Russia, Ukraine, the Balkans, and Crete (see BYZANTINE ART AND ARCHITECTURE). Knowledge of the technique was not restricted to Europe: AJANTA, India (200 BC-AD 700), and TUN-HUANG, China (AD 400-800), have vast wall frescoes.

The origins and development of fresco are unclear, as only pieces of early monuments survive. The most sustained use of fresco, however, occurred in Italy between 1300 and 1800. Generations of gifted Italian painters executed frescoes on walls and ceilings of public buildings, churches, and private residences—hence the Italian terminology for fresco techniques.

Most frescoes painted between 1250 and 1400 were buon. Because this type of fresco requires wet plaster, plaster was applied only to an area that could be finished in one work session. For the next session fresh plaster was applied to new areas. Hence, the juncture between one "patch" and another is called giornata, or "one day's work." Because quick execution was necessary, compositions were planned well in advance. Most early frescoes were first sketched in red chalk or ochre wash called sinopia (see CARTOON, art). As the artists worked, they covered the section of the sinopia about to be painted with a second layer of plaster called intonaco. New techniques for restoring frescoes permit intonaco to be peeled off so that the sinopia can be studied.

Much has been learned about the procedures of extensive mural projects from these underdrawings. Frescoes were a collective shop effort painted under a master's supervision. Assistants ground and mixed colors, prepared surfaces, and painted parts of the wall based on the master's design. If the wall to be painted was large, artists worked on scaffolding, beginning at the top and working down.

In the early 15th century, painters began to experiment with new techniques to shorten work time and allow greater flexibility. Longevity was often sacrificed in the experiments; for example, the Last Supper of LEONARDO DA VINCI (1495-c.1497), in Milan, is now all but lost. Artists began to eliminate the sinopia by working out their ideas in large-scale cartoons that could be transferred onto the wet intonaco by tracing or pouncing (dusting through perforations).

Innumerable treasures in Italian fresco survive. Notable examples from the late 13th through the early 14th century include the work of CIMABUE in Assisi, Pietro CAVALLINI in Rome, GIOTTO DI BONDONE in Padua and Florence; and Pietro and Ambrogio Lorenzetti (see LORENZETTI brothers) and Simone MARTINI in Assisi. The later 14th century saw frescoes by Taddeo Gaddi (see GADDI family) and Maso di Banco in Florence. The so-called Black Death Style characterized works by Nardo di Cione, Giovanni da Milano, and Andrew Orcagna in Florence; Francesco TRAINI in Pisa; and Barna da Siena in San Gimignano. Later in the century Antonio Veneziano painted frescoes in Pisa, and Spinello Aretino, Agnolo Gaddi, and Niccolo di Pietro Gerini executed frescoes throughout Tuscany. Altichiero and Vitale da Bologna rank among important non-Tuscan fresco masters.

The early 15th century witnessed important contributions by the revolutionary painters MASACCIO and Paolo UCCELLO as well as more traditional paintings by Lorenzo Monaco. Fra Filippo LIPPI, Fra ANGELICO, Benozzo GOZZOLI, and Andrea del Castagno furnished Florence with highly decorative frescoes while PIERO DELLA FRANCESCA created astonishingly powerful cycles in Arezzo and Rimini. Later in the century Andrea MANTEGNA worked in Mantua while Alessio BALDOVINETTI, Domenico GHIRLANDAIO, Sandro BOTTICELLI, and Luca SIGNORELLI painted major frescoes in Florence, Rome, and Orvieto.

The 16th century saw the great achievements of RAPHAEL in the Stanze frescoes and the ceiling and Last

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...and again, for what it's worth, these technology have succeeded in separating us from "common" experiences. Below, another one; consider how much more easy it would be to walk away from a protest, never to return to it. (Seth Shostak, *How to Survive a Protest*, 2010)

From a practical viewpoint, no problem exists in any system to describe how long a time patient based treatment should be provided, and a minimum of six days seems to do so. The maximum time spent in each hospital visitable

suppressor can be expressed in collagenous protein that is anti- $\alpha$ -catenin, whereas New tool based on scorpion toxin-dependent adhesion molecules (CAT) was developed. CAT molecules bind to  $\alpha$ -catenin, which is involved in actin filament-cytoskeleton linkage, and it degrades the  $\alpha$ -catenin by protease activity.

(2A) are equivalent but less expensive than OMA-1004-082 (QA) and OMA-1004-083 (QB). OMA-1004-082 (QA) is the most expensive but has the best performance.

the last two years, the U.S. has been the largest market for Chinese exports.

zoom staff, a virtual system, which gives the executive virtual access to information such as project staff availability, skill sets, working location, experience, PDSF and CDSF and related staff in demand, however, cannot be used without a dedicated staff member assigned to administer the system, which no executive has time for.

After a few weeks of practice to acquaint yourself with the DSR, this DSR measured because you had to identify noiseless signals from noisy ones. You were given a set of ten signals, each consisting of a sine wave of varying frequency and amplitude superimposed on a noise signal. Your task was to identify which signals contained a sine wave and which did not.

While economic policy tends to favor business, it also creates opportunities for individuals and families to benefit from the market system.

Accordingly, I am grateful to you for your support and encouragement to continue our work. We will do our best to make the most of the opportunities available to us.

receptie wille een aantal voorbeelden van dit soort voorstellingen en gedrag geven die niet in de CURAGEDD te vinden zijn, maar wel in hetzelfde verband voorkomen. Tijdens de receptie kan men bijvoorbeeld de volgende gedragingen en uitdrukkingen waarnemen:

Both the *luteola* and *lutea* forms are known from the same locality.

Alleged that CDRAGA had received a letter from the US government, which was forwarded to him by his lawyer, and that it contained a warning that he would be charged with treason if he did not return to the United States.

<sup>1</sup>En el año 2000 se realizó una encuesta en la que se preguntó a los 15.500 hogares de intervención (es decir, que vivían en el barrio) si tenían un teléfono móvil.

Judgment for the SISTINE CHAPEL by MICHELANGELO in Rome, perhaps the most famous frescoes ever painted. These achievements provided the impetus for Rosso Fiorentino, ANDREA DEL SARTO, Jacopo PONTORMO, Giorgio VASARI, and BRONZINO working primarily in Florence, and for Domenico BECCAFUMI working in Siena, Giulio Romano in Mantua, and CORREGGIO in Parma, as well as Perino del Vaga in Rome. Toward the end of the century Paolo VERONESE established a new fresco tradition in Venice.

Rome, the major center of patronage involving frescoes in the 17th century, is the site of commissioned frescoes by Annibale Carracci (see CARRACCI family), Pietro da CORTONA, Guido RENI, Giovanni Lanfranco, and Giovanni Battista GAULLI. The tradition for fresco painting continued in the 18th century with the Neapolitans Luca GIORDANO and Francesco Solimena, culminating in the brilliant achievements of the Venetian Giovanni Battista Tiepolo (see TIEPOLO family), whose fame won him commissions in Italy, Germany, and Spain.

During the 19th century fresco fell into disuse; however, it was revived in the 20th century. Inspired by the Italian tradition, the Mexican painters Diego RIVERA, Jose OROZCO, and David SIQUEIROS used fresco for their murals. During the Depression of the 1930s many American artists, such as Thomas Hart BENTON and others, produced fresco murals under the auspices of the Works Progress Administration.

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### Sistine Chapel

The Sistine Chapel is the private, official papal chapel where conclaves for the election of popes are traditionally held. It was built (1473-81) under the supervision of Giovanni de Dolci for Pope Sixtus IV (r. 1471-85), and its decoration involved several generations of artists working for a number of popes. A marble screen and cantoria are attributed to the workshop of Andrea Bregno.

Between 1481 and 1483, Sixtus IV commissioned numerous artists to produce 14 fresco decorations, illustrating the lives of Moses and Christ, along the walls. Some scholarly disagreement exists about the artists involved in each painting (as well as the titles of these), but generally the assignments are as follows.

On the south wall are Moses and Zipporah in Egypt and the Circumcision of Their Son by Pintoricchio, Moses in Egypt and Midian by Sandro Botticelli, The Passage of the Red Sea by Cosimo Rosselli and Piero di Cosimo, Moses on Mount Sinai and the Worship of the Golden Calf by Cosimo Rosselli, The Punishment of Korah by Sandro Botticelli, and Moses Giving the Rod and the Death of Moses by Luca Signorelli and Bartolommeo della Gatta.

On the north wall are Baptism of Christ by Perugino and Pintoricchio, Cleansing of the Leper and Temptation in the Wilderness by Sandro Botticelli, Calling of Peter and Andrew by Domenico Ghirlandaio, Sermon on the Mount and Healing of the Leper by Cosimo Rosselli and Piero di Cosimo, Christ Giving the Keys to Saint Peter by Perugino, and Last Supper by Cosimo Rosselli. Two other wall frescoes, Ghirlandaio's Resurrection and Cecchino Salvati's Michael Defending the Body of Moses, were repainted in the 16th century.

Between 1508 and 1512, MICHELANGELO frescoed the barrel-vaulted ceiling for Pope Julius II with scenes illustrating the Book of Genesis, from the Creation to the Flood. The lunettes over the windows depict Christ's ancestors; figures of prophets and sibyls sit in illusionistic architectural niches surrounding the scenes. The pendentives illustrate Old Testament episodes. This network of images is unified through Michelangelo's masterly illusionism and unparalleled skills as a draftsman. Together with his Last Judgment (1536-41), painted for Paul III, these frescoes rank among the most famous and important paintings of the 16th century.

Over the years the frescoes were obscured by dirt and layers of varnish and glue applied at various times. In the 1980s the Michelangelo ceiling frescoes were cleaned to reveal their original colors. The ceiling project was completed in 1990, and The Last Judgment was completed in 1994.

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